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Fuzzy Logic Based Contactless Risk Dedication and Prevention System to prevent COVID-19 Suspect at Entrance

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***Keywords*— COVID-19, Temperature Fuzzy logic, Contactless measurement, MIMO FIS.**

***Abstract*—** *COVID-19 is a disease caused by a virus that can spread from person to person. The symptoms can vary from mild to severe illness for COVID-19. Body temperature plays an important role to detect COVID-19 symptoms. This article proposes Fuzzy Logic Based contactless risk dedication and prevention system at entrance. The proposed system measures the contactless body temperature of the individual at the entrance. Fuzzy logic takes the decision to allow the person inside at the entrance. Based on a fuzzy decision system open or close the gate. The system is automatic and does not need any human operator that helps to prevent further pandemic.*

I. INTRODUCTION

Nowadays coronavirus (covid-19) becomes a serious health concern causing severe health issues in human beings and it becomes a pandemic [1]. It may spread via polluted hands [2, 3]. Normal body temperatures for adults range between 36.1°c and 37.2°c. Time of the day can impact human body temperature. Human body temperature falls down at night and increases over the day. Increased human body temperature is one of the first symptoms of illness, and a fever is a sign that the human body is fighting some infection. Fever is also a common symptom of the coronavirus [4, 5]. The proposed system is able to measure non contact body temperature by using an infrared sensor module. Slightest differences and abnormal body temperature can be detected and will result in alarm. The fundamental block diagram of the system is shown in Figure 1. Circuit diagram of the Contactless Risk Dedication and Prevention System is shown in Figure 2.

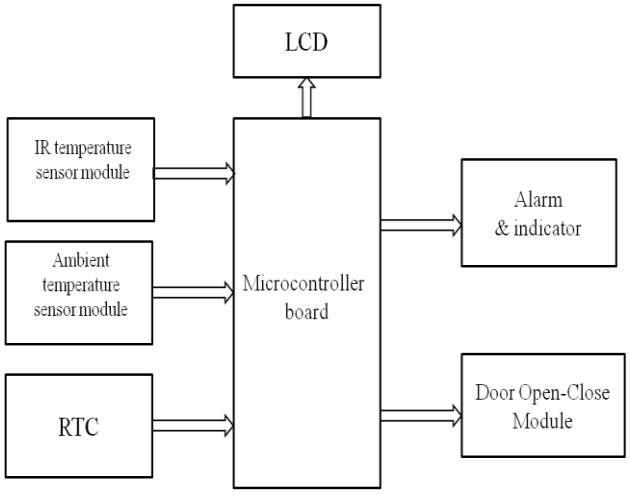


Fig :1 Contactless Risk Dedication and Prevention System

II. NON-CONTACT INFRARED TEMPERATURE MEASUREMENT

Ambient temperature is also an important factor that affects human body temperature. Lm35 analog output sensor is used to measure ambient temperature. To measure human body temperature infrared temperature MLX90614 sensor is used that enables high accuracy of 0.5°C and resolution of 0.02°C over a wide temperature range. Mlx90614 is an infrared based sensor, it measures the temperature based on infrared emitted by an object. It senses electromagnetic waves in the range about 700 nm to 14,000 nm [6]. The microcontroller board used is Arduino Uno that provides an open source hardware platform.

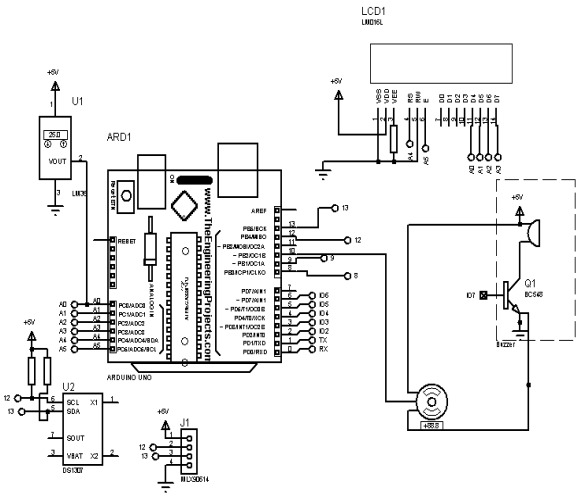


Fig. 2: Circuit diagram of the Contactless Risk Dedication and Prevention System

- Fuzzy logic inference Fuzzy logic allows taking precise decisions from input vogues data. Fuzzy logic allows to model complex, non linear dependency that exist between input and output variables of a system. A Fuzzy Logic inference consists of three-parts: fuzzification of input, defuzzification of output, and Knowledge representation in the form of IF-THEN rules. Input a real scalar value is converted into a fuzzy value in the fuzzification procedure. To detect the possible severity of COVID-19 the fuzzy inference system is designed as shown in Figure. 3. The fuzzy inference system consists of two inputs and one output namely body temperature, ambient temperature and factors Severity. Triangular shape membership functions are used to fuzzify the input.

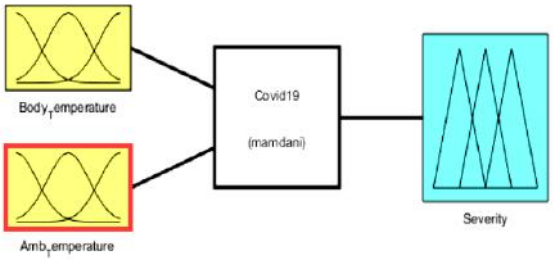


Fig.3: Structure of fuzzy inference system

Figure 4 shows the fuzzy sets of input linguistic variables labeled with Low, Medium and High. In present study typically two input variables have been considered temperature and ambient temperature. Similar to the input variable fuzzy memberships function is assigned to output variable. The fuzzy sets used for Severity are Low, Normal and Severity. The graphical interpretation of the membership function for output fuzzy variable is shown in Figure 5.

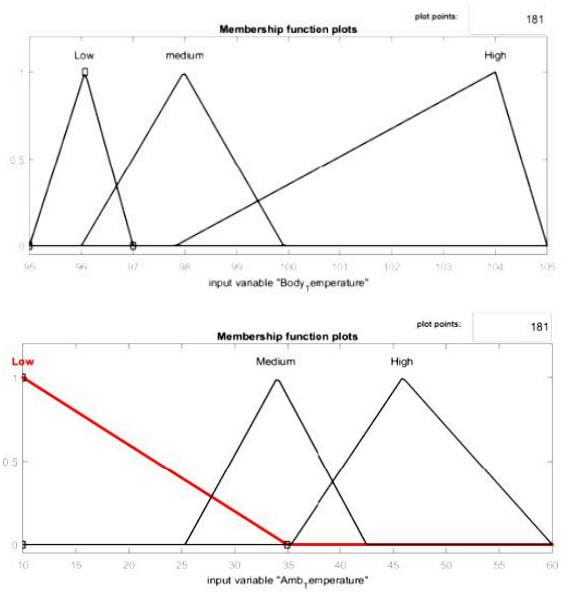


Fig.4: Triangular shape Membership Function for Input Linguistic Variables

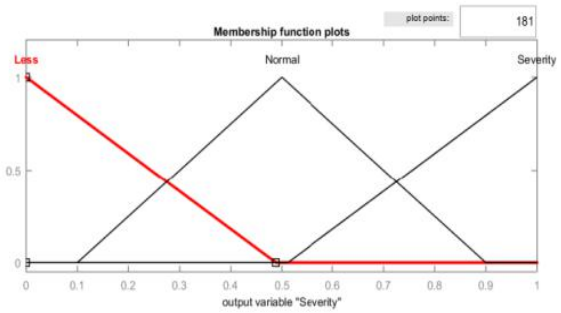


Fig. 5: Membership Function for Output Linguistic in three categories Less- Severe, Normal and Severe

After fuzzification of input variable next stage is deciding what will be the level of severity. The input situation is expressed after 'IF' while output situation is described after 'THEN' part. The Fuzzy rule policy for contactless risk dedication is structurally formulated as shown in Table 1.

Fuzzy Logic inference generates the output for different input conditions and is tabulated in table I to IV. From table I to IV it is observed that degree of severity is less for less infected suspect and it goes increasing as is more infected suspect. In the article [7] we have demonstrated how to synthesize Fuzzy inference in microcontroller using Embedded-C language without any spatial software tool. If Fuzzy Logic inference output i.e. degree of severity is in normal range then the system open the door by using electronics actuator else door is closed hence preventing COVID-19 suspect at Entrance.

Table 1: Fuzzy Rule base for Contactless Risk Dedication

Severity		Body Temperature		
		Low	Medium	High
Ambient temperature	Low	Less	Normal	Severity
	Medium	Less	Normal	Severity
	High	Less	Less	Severity

Table 2: Normal Severity level of the Suspect

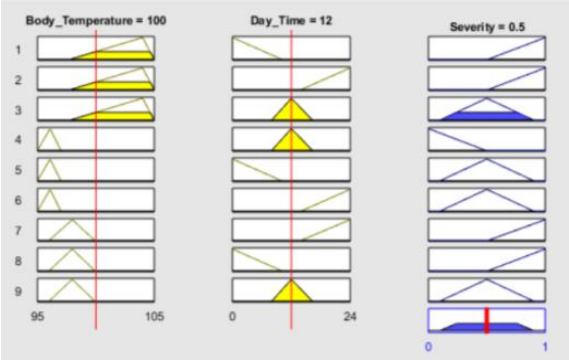


Table 3: Less Severe level of Suspect

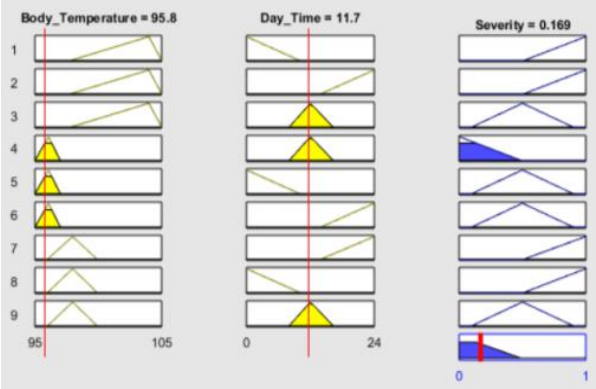
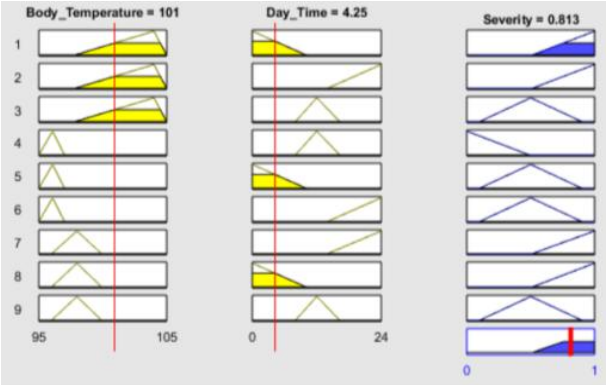


Table 4: Severe level of Suspect



III. CONCLUSION

The proposed system can measure reliable body temperature without any contact to the body, it also evaluates and displays possible risk of COVID-19 in real time, and it is alarming at detection of risk and preventing the entry of the person. The system is automatic and does not need any human operator. This allows the proposed system to be useful to the risk dedication and prevent COVID-19 infected persons at entrance to prevent further pandemic.

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